# Prioritising Coastal Adaptation Development Options for Local Government


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**Final Report**

# A Guide to Monitoring and Evaluating Coastal Adaptation

Australian Government
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University of the Sunshine Coast
Sustainability Research Centre

Sydney Coastal Councils Group

Coastal Adaptation Decision Pathways Project **(CAP)**

# A Guide to Monitoring and Evaluating Coastal Adaptation

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Australian Government
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## Executive summary

This guide provides a basis for monitoring and evaluating the climate change adaptation strategies and practices of Local Governments in coastal areas. It is based on a literature review of monitoring and evaluation relevant to coastal adaptation, as well as an online survey and workshops with the 15 member councils of the Sydney Coastal Councils Group, the Sunshine Coast Council, and Bega Valley Shire Council.

The guide provides practitioners with a comprehensive process for assessing the sustainability, feasibility and efficacy of coastal adaptation strategies at strategic phases throughout the adaptation process. In particular, the guide is designed to facilitate assessment of adaptation planning, implementation and progress against best practice. Consideration of relevant spatial and temporal scales is also included to avoid negative path dependencies and limitations upon future transitions to alternative adaptation pathways. Thus, it is designed to be adapted to the specific contexts and needs of agencies and includes a series of downloadable templates for practitioner use.

The sequence of templates guides practitioners through an iterative practice that begins with a preliminary/rapid appraisal and progresses to more detailed evaluations of the intentions and principles of adaptation, organisational capacity and the effectiveness of strategies once implemented. Worked examples drawn from hypothetical case studies representing contexts relevant to New South Wales and Queensland are included to demonstrate the application and utility of the guide. The guide is relevant to all council divisions and other stakeholders involved in planning, implementing, monitoring and evaluating climate change adaptation.

The monitoring and evaluation frameworks within this guide are designed to compliment the selection of adaptation options through the multi-criteria analysis tool developed by Preston *et al*. (2012). The guide also provides an overview of relevant existing monitoring and evaluation programs in New South Wales and Queensland to facilitate the integration of monitoring and evaluation efforts.

# Contents

## Introduction

Coastal adaptation is of increasing importance to Local Governments in coastal areas as they address the impacts of climate change and to reduce vulnerability to extreme events. A range of adaptation strategies has been identified in the climate change literature (Mangoyana *et al*., 2012). However, few Local Governments have implemented adaptation strategies and tools to evaluate the effectiveness of intentions and efforts are limited. This guide is designed to assist Local Governments in the monitoring and evaluation of climate change adaptation plans, strategies and activities. It compliments the Multi-Criteria Analysis report (Preston *et al*.) also developed as part of this Coastal Adaptation Pathways project, which is focused on the selection of adaptation options. The evaluation templates within the guide have been developed to ensure relevance to all council divisions and other stakeholders involved in planning, implementing, monitoring and evaluating climate change adaptation. In particular, they facilitate appraisal of:

- the values and principles guiding coastal adaptation plans; and
- the feasibility and effectiveness of adaptation strategies within plans (i.e. the ability of agencies to successfully implement adaptation options).

The guide begins with a summary checklist of key considerations in adaptation and is followed by comprehensive templates to guide agency staff through a more detailed evaluation of the effectiveness of adaptation planning and decision-making. Figure 1 provides a synopsis of the Local Government adaptation process, and indicates the phases to which the evaluation templates are aligned. It is important to note the iterative nature of the adaptation phases and the importance of the feedback loops, initiated through evaluation, that drive the overall process.

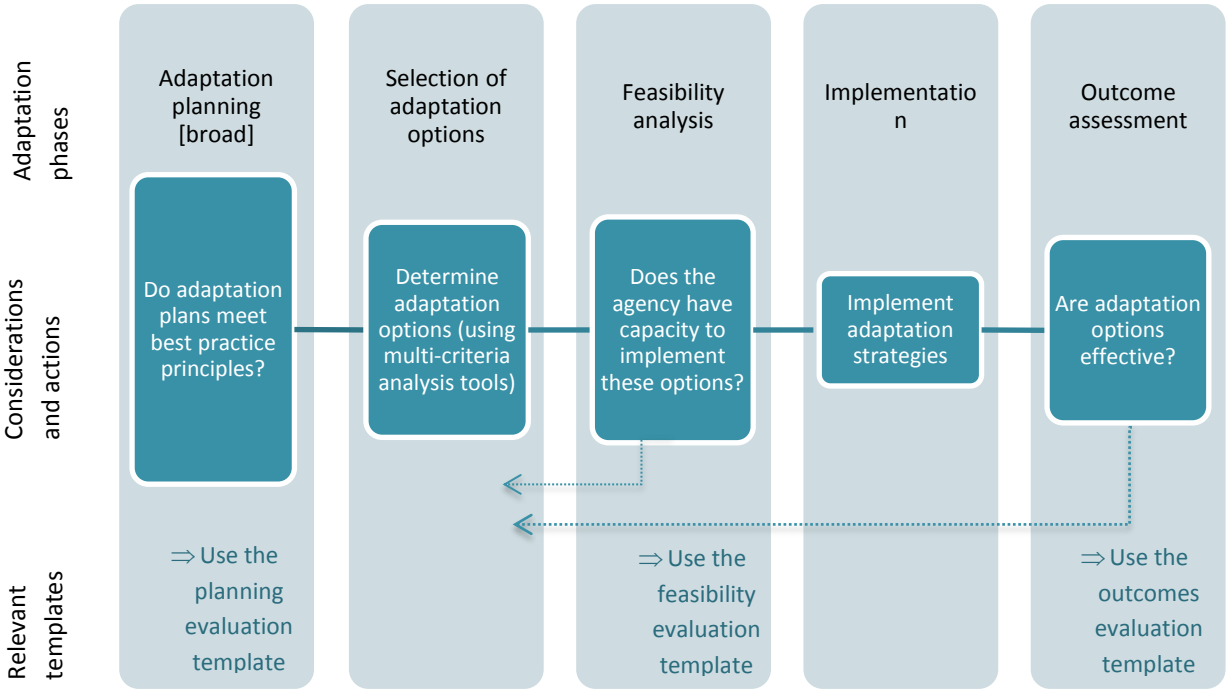


**Figure 1** Schema of Local Government adaptation process indicating the role of evaluation and its uses

## Why undertake monitoring and evaluation?

Monitoring and evaluation are typically undertaken at the end of a program to demonstrate accountability, including the wise use of resources. However, without an analysis of the *process* (i.e. the factors contributing to outcomes) it is difficult for agencies to identify how good performance can be replicated, or how to adjust to improve performance. It is important to consider evaluation as a *learning strategy* as opposed to an *auditing procedure* and to conduct monitoring and evaluation regularly throughout programs—we have developed evaluation templates that can be used to help Local Government staff to engage in deliberative processes across the following three phases of adaptation: (1) planning; (2) feasibility/capacity analysis; and, (3) outcome assessment.

The evaluation frameworks within this guide are designed to be consistent with existing monitoring and evaluation frameworks of relevance to Local Government in the context of coastal adaptation (see Tables 1 and 2 in the following section for an overview of plans and policies within the New South Wales and Queensland contexts).

## Existing relevant monitoring and evaluation in New South Wales and Queensland

Monitoring and evaluation of climate change adaptation is not currently required in New South Wales. Most NSW policy and planning responses to climate change emphasise emissions reduction and efficient resource use. In some cases, initiatives are voluntary and in other cases, compulsory. Monitoring and evaluation for climate change adaptation activities cut across many State initiatives. In some cases, initiatives provide cursory notes that evaluation will be required, without detailing specific indicators or frameworks for evaluation. In other cases, councils may have developed their own systems for addressing the information needs of state government departments. Table 1 outlines some initiatives that have a monitoring and evaluation component and may be relevant to climate change adaptation at the Local Government scale. Table 1 also links those initiatives to the templates presented in this report relating to monitoring and evaluation of adaptation planning, option feasibility, and adaptation outcomes.

Monitoring and evaluation of climate change adaptation is not currently required in Queensland. Four key policy and planning initiatives inform evaluation of climate change adaptation in the state: (1) the State Policy for Coastal Management; (2) The State Coastal Planning Policy; (3) Regional Natural Resource Management Plans (e.g. South East Queensland NRM Plan); and (4) State of the Environment reporting (Coastal section). The relevance of each of these to the proposed evaluation templates is described in Table 2.

**Table 1:** Related policies and programs and links between monitoring and evaluation components (New South Wales)

| Policy/program | Short description / Relevant section | Monitoring and evaluation emphasis | Purpose of evaluation | Perceived relevance to coastal adaptation | Links to the monitoring and evaluation tools (presented in this report – M&E guides) |
|---|---|---|---|---|---|
| BASIX Building Sustainability Index for new residential development | Water, thermal comfort and energy use efficiency standard for all new buildings. | New buildings must meet target levels for resource use efficiency. | Standard – minimum requirements | Of relevance to new buildings in the coastal zone | BASIX could be linked to adaptation strategies involving new buildings |
| NSW Government Sustainability Policy | Requirements related to office buildings, water and energy efficiency and fleet management. | Annual reporting required from government against a minimum standard. | Auditing of standard compliance, benchmarking | Not directly relevant | |
| NSW priorities for biodiversity adaptation to climate change | Priority 7 identifies that OEH (DECCW) will work in coordination with local councils to explore biodiversity within the context of land-use planning. Specific areas include:<br>• Improved understanding.<br>• Building a protected area system.<br>• Integrating adaption into regional planning.<br>• Regulating land use planning, integrating adaptation.<br>• Increasing awareness of climate change. | Note that performance will be tracked and priorities reported on in 2015, although there is no mention of specific indicators or evaluation framework. | Auditing | Some internal systems in relation to reporting against regulating land use planning, integrating adaptation considerations, should be in use or their need anticipated. | Biodiversity should be explicitly considered under environmental adaptation options<br><br>(links to the 'Outcomes Evaluation Template' presented in this report) |

| | | | | | |
|---|---|---|---|---|---|
| NSW 2021 | Goal 23.3 Minimise impacts of climate change in local communities | Indicators of impact projections to be reported against annually | Auditing | | General relevance to the M&E guide. |
| Sydney Metropolitan Plan 2036 | Goal 2.1 Climate Change adaptation strategy developed by local councils.<br>Goal 2.2 Building Sustainability Index BASIX incorporated into new activities.<br>Goal 2.3 Green cover initiatives.<br>Goal 2.4 Urban design and renewal. | Action 17.2 Undertake a review of the plan every 5 years. | Although it says adaptive management, no consideration has been given to how information will inform management. | The Sydney Metropolitan Plan 2036 is currently being revised and a new Metropolitan Strategy for Sydney is due for release in late 2012 | Note the requirement for a climate change adaptation strategy at the Local Government level. Adaptation strategies and monitoring methods should consider urban design, green cover and the BASIX assessment. |
| NSW Waste and Sustainability Improvement Payments (WaSIP) – Program | The Local Council Waste and Sustainability Improvement Payments (WaSIP) assist councils invest in actions and programs that improve resource recovery and sustainability outcomes across their Local Government areas.<br><br>In 2011-12 Sydney Metropolitan Area and Extended Regulated Area councils were required to prepare a climate change risk assessment of their operations under this program. | The guide stresses ongoing monitoring and revision of identified risks so as to:<br>• incorporate new climate change information as it becomes available<br>• check that controls are effective<br>• include new information gained from events<br>• account for any changes in context<br>• identify new risks | Allows for learning and improvement | Risk assessment for coastal councils will include coastal erosion, flooding and inundation. | A Guide to the first step (risk assessment) in preparing an adaptation plan or strategy.<br><br>(links to the 'Planning Evaluation Template' presented in this report) |

| | | | | | |
|---|---|---|---|---|---|
| | A guide for identifying climate change risks, based on the ANZ standard for risk assessment, was provided to assist councils to:<br>• undertake a qualitative climate change risk assessment for the first time, using a standard approach<br>• refine previous risk assessments<br>• generate information that can be used to develop strategies to adapt to changing climate and make decisions in conditions of risk and uncertainty | | | | |

**Table 2:** Related policies and programs and links between monitoring and evaluation components (Queensland)

| Policy/program | Short description / Relevant section | Monitoring and evaluation emphasis | Purpose of evaluation | Perceived relevance to coastal adaptation | Links to the monitoring and evaluation tools (presented in this report – M&E guides) |
|---|---|---|---|---|---|
| State Policy for Coastal Management | The State Policy covers 12 key areas related to coastal management:<br>1. Natural coastal processes<br>2. Erosion prone buildings and structures<br>3. Dune management<br>4. Protection of areas of high ecological significance<br>5. Traditional Owner involvement<br>6. Public Access<br>7. Building and structures on state coastal land<br>8. Driving on beaches<br>9. Local area coastal management plans (considering 1-8)<br>10. Monitoring and review<br>11. Knowledge and awareness<br>12. Community engagement<br>Background text makes clear that the policy is in part a response to climate change. | As part of local area coastal management plan review, agencies are required to monitor resource extent and condition, and management outcomes. Assessment of monitoring is required to inform plans, and operational plans resulting from them. Monitoring data is also required to inform 4 yearly State of the Coastal Zone report forms, which feed into the Queensland State of the Environment reporting. | Learning and accountability to public | High relevance | The policy includes components for consideration in adaptation strategy development. Further, opportunity exists to link and align monitoring of climate change adaptation strategies proposed in this report to that required for coastal plans. The capacity assessment proposed in the 'Feasibility Evaluation Template' (presented in this report) could be adapted to meet the needs of reporting for areas 10-12. |

| | | | | | |
|---|---|---|---|---|---|
| The State Coastal Planning Policy | The planning policy provides detail of performance outcomes related to each of the following:<br>• Land use planning<br>• Hazards<br>• Conservation<br>• Amenity<br>• Access<br>• Coastal development<br>• Canals and water ways | The planning policy provides a specific minimum indicator set for Local Area Coastal Management Plans. | Learning and benchmarking | High relevance | Alignment with indicators related to the 'Outcomes Evaluation Template' presented in this report. |
| South East Queensland NRM Plan | The SEQ plan contains a range of targets related to the following:<br>• Air and atmosphere (4 targets)<br>• Coastal and Marine (7 targets)<br>• Community (1 target)<br>• Land (9 targets)<br>• Nature Conservation (6 targets)<br>• Regional landscape areas (5 targets)<br>• Traditional owners (1 target)<br>• Water (7 targets) | Monitoring information for each of these targets (indicators unspecified) is designed to feed into federal MERI reporting, State of the Region reporting, and State of the Environment reporting | Learning and accountability to public | High relevance | Alignment with indicators related to the 'Outcomes Evaluation Template' and 'Feasibility Evaluation Template' presented in this report. |

| | | | | | |
|---|---|---|---|---|---|
| State of the Environment | The Queensland State of the Environment Report includes a section on the coastal zone. Indicators are organised into key themes:<br>• Coastal land use<br>• Acid sulphate soils<br>• Coastal habitats and biodiversity<br>• Physical processes and coastal variability | State of the Environment reporting occurs periodically (3-5 years). The last publically available report was produced in 2007. | Auditing | High relevance | See State Policy for Coastal Management and State Coastal Planning Policy. Alignment with indicators related to the 'Outcomes Evaluation Template' presented in this report. |

## Using this guide

The series of evaluation templates are designed for use throughout all stages of adaptation programs (planning, option selection, and implementation). Use of the templates will be dependent on where in the adaptation cycle particular Local Governments are located and their individual contexts—thus the templates have been devised for Local Governments to modify to specific needs and purposes and are not prescriptive. Refer to Figure 2 to assess which templates are relevant for application and use within your Local Government. Sample templates are also included at the end of the guide to illustrate the application of the templates.

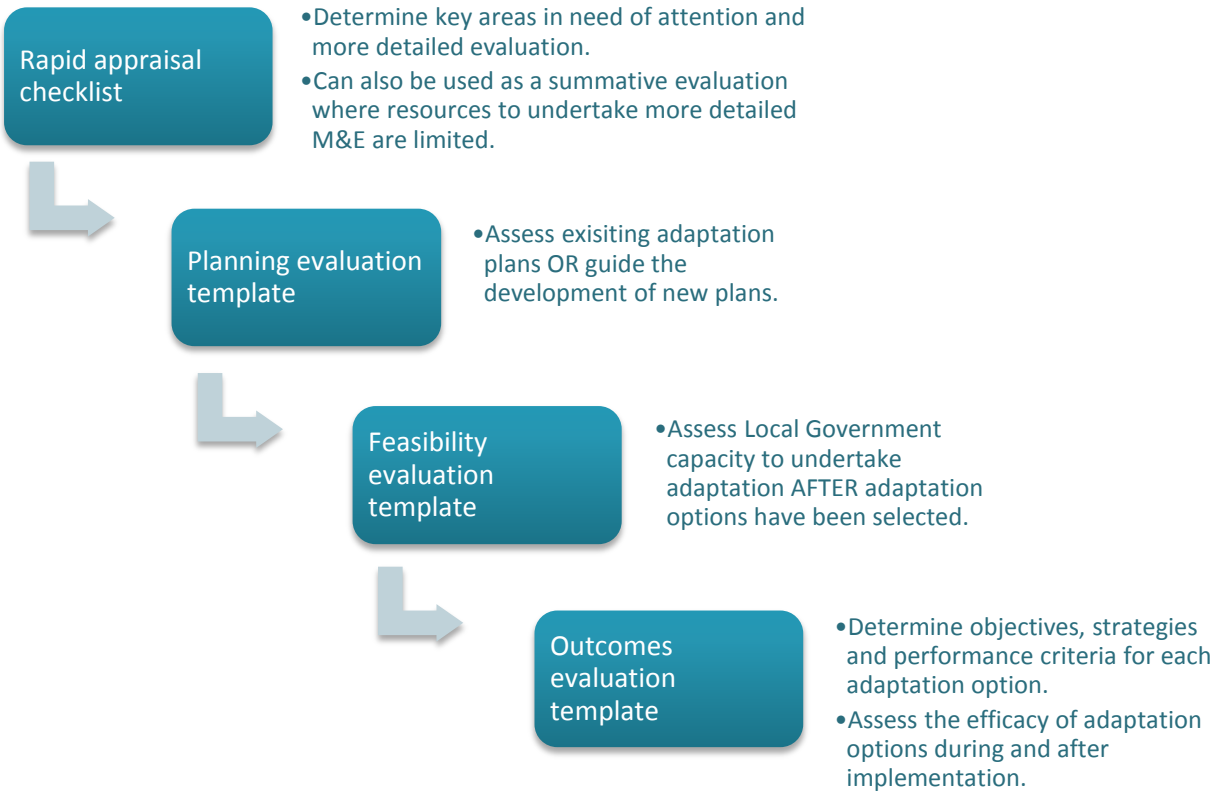


**Figure 2** Use and application of evaluation templates

## Rapid appraisal checklist

The Rapid Appraisal Checklist facilitates a summary analysis of adaptation planning, capacity and efficacy from a Local Government perspective. It may be used as a preliminary first step in monitoring and evaluation processes to guide more comprehensive efforts or it may be used in place of more detailed evaluations where capacity (e.g. time and staff) is limited. All templates are designed to facilitate dialogue through inclusive and participatory processes. All evaluations should seek to engage all relevant staff and stakeholders. Work through the following checklist noting agreement, disagreement or uncertainty for each criterion.

| | |
|---|---|
| ⇒ **Adaptation plan assessment** | |
| Integrated: *policies, plans and actions are consistent across communities, government, and relevant industry sectors* | ✖/✓/? |
| Equitable: *adaptation strategies are cognizant of the costs and benefits to the diversity of community and industry sectors.* | ✖/✓/? |
| Sustainable: *strategies consider the quadruple bottom line and avoid maladaptation.* | ✖/✓/? |
| Informed: *decisions are based on a range of knowledge sources (e.g. scientific, indigenous and local).* | ✖/✓/? |
| Responsive: *strategies recognise uncertainties and respond to changing socio-ecological contexts.* | ✖/✓/? |
| ⇒ **Feasibility: adaptive capacity** | |
| Human capital: *staff have the knowledge, skills and time to develop, implement and evaluate adaptation strategies.* | ✖/✓/? |
| Organisational capital: *organizational goals, structures and processes facilitate the development, implementation and evaluation of adaptation strategies.* | ✖/✓/? |
| Social capital: *connections with all relevant community and industry stakeholders represent supportive networks.* | ✖/✓/? |
| Natural capital: *sufficient natural resources (e.g. available land, freshwater supplies, riparian/dunal vegetation, raw materials) are accessible to facilitate adaptation.* | ✖/✓/? |
| Built capital: *sufficient infrastructure and capital assets are available to support adaptation.* | ✖/✓/? |
| Financial capital: *adequate amounts of financial resources have been allocated in council budgets and/or accessible through other sources of funding*. | ✖/✓/? |
| ⇒ **Effectiveness: adaptation outcomes** | |
| Environmental outcomes | ✖/✓/? |
| Social outcomes | ✖/✓/? |
| Economic outcomes | ✖/✓/? |
| Governance outcomes | ✖/✓/? |

**Figure 3** Rapid Appraisal Checklist for assessing best practice in adaptation planning, including the feasibility and effectiveness of adaptation options

# Planning evaluation template

## Rationale

Evaluating the over-arching goals of adaptation plans and policies is an important step in developing sustainable adaptation strategies. Five principles for effective adaptation plans are evident in the literature (e.g. Adger 2005; Prutsch et al. 2010; Mangoyana et al. 2012). These are:

- Integration across sectors and scales (e.g. integrates stakeholders' interests);
- Equity (e.g. distribution of costs and benefits);
- Sustainability and quadruple bottom line considerations (e.g. social, economic, governance and environmental dimensions);
- Inclusion of diverse knowledge types and sources (e.g. scientific, local and indigenous knowledge); and
- Responsiveness (e.g. mechanisms that are flexible enough to accommodate uncertainties in order to facilitate best practice adaptation).

## Application

Use the Planning Evaluation Template to assess adaptation plans against best practice principles. Engage all relevant staff and stakeholders in this evaluation component to facilitate dialogue about the merits of adaptation strategies as appropriate for particular contexts. Individual regions may wish to include additional guiding principles (e.g. resilience) or adjust performance criteria to suit their particular needs and aspirations.

**Planning Evaluation Template:** Monitoring and evaluating adaptation plans

| Guiding principle | Performance Criteria | Strongly agree | Agree | Disagree | Strongly disagree | Don't know |
|---|---|---|---|---|---|---|
| **Integrated:** *policies, plans and actions are consistent across government, communities, and relevant industry sectors.* | Adaptation policy and plans are consistent with Council policies and plans. | | | | | |
| | Adaptation policy and plans are consistent with State and National policies and plans. | | | | | |
| | Staff from all relevant Council divisions and other government agencies (as appropriate) are engaged to ensure synergistic strategies. | | | | | |
| | Representatives from all relevant industry sectors are engaged to ensure synergistic strategies. | | | | | |
| | Representatives from all relevant community sectors are engaged to ensure synergistic strategies. | | | | | |
| **Equitable:** *adaptation strategies are cognizant of the costs and benefits to the diversity of community and industry sectors.* | Strategies recognize and are cognizant of the costs and benefits to the diversity of community sectors. | | | | | |
| | Strategies recognise and are cognizant of the costs and benefits to the diversity of industry sectors. | | | | | |
| **Sustainable:** *strategies consider the quadruple bottom line and avoidance of maladaptation.* | Environmental, social, economic and governance issues are considered to enhance the long-term sustainability of adaptation strategies. | | | | | |
| **Informed:** *decisions are based on a range of knowledge sources (e.g. scientific, indigenous and local).* | A range of evidence is considered and weighted appropriately to develop adaptation strategies that consider the needs, vulnerabilities and risks of particular contexts. | | | | | |
| **Responsive:** *strategies recognize uncertainties and respond to changing socio-ecological contexts.* | Multi criteria analysis (or other tools) is used to develop, refine and adjust adaptation strategies. | | | | | |
| | Monitoring and evaluation is conducted regularly, and at appropriate spatial and temporal scales to inform key uncertainties around adaptation practice. | | | | | |
| | Transition points exist for switching between adaptation strategies (e.g. social, economic and environmental costs associated with protect versus retreat) | | | | | |

# Feasibility evaluation template

## Rationale

Adaptive capacity is a measure of organisational ability or potential to implement adaptation. It can be evaluated by assessing a range of *capitals* (e.g. Bourdieu 1986; Bebbington 1999; Emery and Flora 2006; Nelson et al. 2010a and Nelson et al. 2010b) within or accessible to organisations that can be mobilised to undertake adaptation. The Feasibility Evaluation Template is based on a capitals framework and provides a checklist for council staff to assess capacity constraints and opportunities across the following dimensions:

- human
- organisational
- social
- natural
- built
- financial

## Application

Use the Feasibility Evaluation Template once adaptation plans have been developed and various adaptation options generated. The Feasibility Evaluation Template is designed to assess your organisation's capacity to undertake various adaptation options.

Capacity constraints may be overcome through a variety of means such as training or collaboration with other divisions or agencies. However, if capacity constraints cannot be overcome then revision of adaptation plans, re-consideration of adaptation options and/or capacity development may be necessary (depending on the extent of constraint). In this way, capacity constraints may influence the choice of adaptation strategy (i.e. protect, accommodate, retreat) especially when changes in capacity over time are considered.

Additional capitals or considerations relevant to the capacity of your agency may also be added to this template (e.g. political capacity, legal capacity etc).

**Feasibility Evaluation Template:** Monitoring and evaluating organisational capacity to implementation adaptation options

| Capacity | Performance Criteria | Strongly agree | Agree | Disagree | Strongly disagree | Don't know |
|---|---|---|---|---|---|---|
| **Human capital:** *personnel have the knowledge, skills and time to develop, implement and evaluate adaptation strategies.* | Staff have (or can acquire) adequate knowledge and skills, or access to appropriate training, to develop and implement adaptation strategies | | | | | |
| | The time allocated to staff is sufficient for the development of adaptation strategies. | | | | | |
| | The time allocated to staff is sufficient for the implementation of adaptation. | | | | | |
| | The time allocated to staff is sufficient for the monitoring and evaluation of adaptation. | | | | | |
| **Organisational capital:** *organisational goals, structures and processes facilitate the development, implementation and evaluation of adaptation strategies.* | Organisational strategy and plans are consistent with the goals of adaptation. | | | | | |
| | Senior staff within the organization champion the need for adaptation. | | | | | |
| | Communication and coordination between divisions is sufficient for the development, implementation and evaluation of adaptation strategies. | | | | | |
| **Social capital:** *connections with all relevant community and industry stakeholders represent supportive networks.* | Processes have been developed and are used effectively for interacting with relevant community sectors to facilitate adaptation planning, implementation and evaluation | | | | | |
| | Processes have been developed for interacting with relevant industry sectors to facilitate adaptation planning, implementation and evaluation | | | | | |
| **Natural capital:** *sufficient natural resources (e.g. available land, freshwater supplies, riparian/dunal vegetation, raw materials) are accessible to facilitate adaptation.* | Natural resources necessary for adaptation are present in the relevant locale or can be accessed externally in a sustainable manner. | | | | | |
| **Built capital:** *sufficient infrastructure and capital assets are available to support adaptation.* | Infrastructure and capital assets necessary for adaptation are present (or will be when necessary) in the relevant locale. | | | | | |
| | The condition/state of infrastructure and capital assets is sufficient for the purposes identified in adaptation plans. | | | | | |
| **Financial capital:** *adequate amounts of financial resources have been allocated in council budgets or accessible through other sources of funding*. | Sufficient financial resources for adaptation planning, implementation and evaluation are included in relevant Council budgets or can be sourced externally or are planned for future expenditure. | | | | | |

# Outcomes evaluation template

## Rationale

The Outcomes Evaluation Template is based on the quadruple bottom line (environmental, social, economic, governance) and links adaptation strategies to adaptation objectives and performance criteria. Please see the Sydney Coastal Councils Group website (Monitor2Manage) for more information on methodological considerations associated with the design and implementation of monitoring programs. In addition to facilitating the assessment of the effectiveness of strategies across environmental, social, economic and governance dimensions, this template also assists in the identification of trigger points that suggest the need to transition from one strategy to another.

## Application

The Outcomes Evaluation Template can be used to:

- guide the development of strategies; and
- assess the efficacy of strategies once implemented.

To guide the development of strategies, the template should be used to identify adaptation objectives, strategies and performance criteria before options are implemented. This will help to ensure: (1) alignment between objectives and implementation strategies; (2) prior consideration of the range of impacts according to the quadruple bottom line dimensions of sustainability; and (3) adequate allocation of resources for monitoring and evaluation as part of implementation.

To assess the efficacy of strategies once implemented, performance indicators should be developed and measured over time to determine progress towards performance targets and temporal trends. A regular monitoring regime is recommended based on the anticipated frequency of changes and response to episodic events.

This Outcomes Evaluation Template is generic and should be developed and refined to suit specific adaptation strategies and/or sub components of strategies (e.g. the construction of protective works, the implementation of building codes, the relocation of vulnerable communities). Consideration should also be given to the robustness of monitoring efforts such whether data are collected and analysed in a standardised way and how the effectiveness of adaptation actions will be discerned. Additional options may include collecting data prior to undertaking interventions or collecting data in areas where no or different interventions have been undertaken.

The following Erodeville, Splash City and Tide Town case studies provide worked examples of the potential application of this template across the three most prevalent coastal adaptation strategies of protect, accommodate and retreat.

**Outcomes Evaluation Template:** Monitoring and evaluating the performance of adaptation strategies

| Adaptation objectives | Performance criteria | Performance indicators | | |
|---|---|---|---|---|
| | | Meeting or exceeding desired outcome/trend | | |
| | | Moving towards a desired outcome/trend | | |
| | | Limited to no changes towards a desired outcome | | |
| | | Not meeting desired trend and showing signs of decline | | |
| | | Data unavailable in reporting period | | |
| **Environmental** | | **Time 1** | **Time 2** | **Time 3** |
| *Insert your environmental goals here. Use a separate row for each goal.* | | | | |
| | | | | |
| **Social** | | | | |
| *Insert your social goals here. Use a separate row for each goal.* | | | | |
| | | | | |
| **Economic** | | | | |
| *Insert your economic goals here. Use a separate row for each goal.* | | | | |
| | | | | |
| **Governance** | | | | |
| *Insert your governance goals here. Use a separate row for each goal.* | | | | |
| | | | | |

**Step 1:** Insert your adaptation objectives here.

**Step 2:** Insert your adaptation strategies here. These are the specific actions to meet your objectives.

**Step 3:** Insert your performance criteria here. These should be linked to your strategies.

**Step 4:** Use a rating system to track progress over time and to demonstrate trends.

## Hypothetical case examples

The following hypothetical case examples are provided to illustrate the use of the Outcomes Evaluation Template across the three broad categories of coastal adaptation: protect, accommodate and retreat. It should be noted that each case is represented in a simplistic manner for illustrative purposes only. Furthermore, in many instances a combination of adaptation strategies (protect, accommodate and retreat) would be implemented simultaneously.

### Protect measures - Erodeville Case

"Protect" strategies (e.g. seawalls, breakwaters and beach nourishment) are implemented to dissipate, absorb and/or reflect wave energy to protect communities and infrastructure from erosion, storm surge and flooding. While "protect" measures provide protection they can also create or exacerbate other coastal problems during construction and operation (e.g. erosion of adjacent sites). In addition, the ability to protect also depends on the magnitude and frequency of extreme events. The "Erodeville" case provides an illustrative example of key monitoring and evaluation issues associated with protect strategies. The example is based on the actual monitoring of Narrowneck beach in Gold Coast, Queensland (Jackson and Hornsey 2003, Corbett et al. 2007).

Erodeville had implemented a number of protection measures including rock walls and beach nourishment following a series of cyclones (since 1950 Erodeville has experienced an average 1.4 cyclones per year, exacerbating erosion). As erosion continued the rock wall at Erodeville became exposed to wave attack leading to a narrower beach and declining popularity of the area as a recreational destination (e.g. loss of beach amenity and deteriorating wave conditions for surfers). To address this, various schemes were investigated using multi-criteria analysis leading to the recommendation, in 2002, of "continued beach nourishment and the construction of an artificial reef" to limit down drift erosion and enhance surfing amenities to attract tourists to Erodeville beach. Key issues for consideration included a range of social, governance, economic and environmental issues to:

- Improve structural stability and durability of protective measures to stabilize the beach and dunes from erosion associated with climatic impacts;
- Enhance habitat restoration and recreational amenities;
- Limit negative environmental impacts on adjacent sites (e.g. erosion);
- Ensure cost efficiency;
- Create new economic activities; and
- Avoid litigation.

Specific strategies, indicators and measures were then developed to monitor and evaluate progress towards achieving positive social, economic and environmental outcomes (see Case Study 1 Template).

**Case Study 1 Template:** An example case of monitoring and evaluating the performance of a protective adaptation strategy (e.g. the construction of an artificial reef)

| Adaptation objectives | Strategies | Performance criteria | Performance indicators<br>● Meeting or exceeding desired outcome/trend<br>● Moving towards a desired outcome/trend<br>● Limited to no changes towards a desired outcome<br>● Not meeting desired trend and showing signs of decline<br>● Data unavailable in reporting period | | |
|---|---|---|---|---|---|
| **Environmental** | | | **Time 1** | **Time 2** | **Time 3** |
| *Protection of beach and dunes from erosion associated with sea level rise and storm surge* | Construction of a submerged reef to reduce wave velocity and retain sand by reducing longshore drift | Volume of sand on beach and in dunes | ● | ● | ● |
| | Beach nourishment | Volume of sand on beach and in dunes | ● | ● | ● |
| *Create and maintain habitat and food sources for marine fauna* | Placement of sand and shells in geotextile containers on reef to encourage habitat development | Change in species abundance and composition | ● | ● | ● |
| | Forbid anchoring along the reef zone to avoid damage to habitat and the structure | Extent of reef zone damage caused by anchoring | ● | ● | ● |
| *Limit negative impacts of adaptation strategies on associated sites* | Periodic monitoring of impacts on adjacent sites | Adjacent beach width | ● | ● | ● |
| | | Change in species abundance and composition in associated sites | ● | ● | ● |
| **Social** | | | | | |
| *Maintain or enhance recreational amenity* | Enhance beach access | Change in number of visits | ● | ● | ● |
| | Enhance beach usability/utility | Change in number of recreational uses | ● | ● | ● |
| | Design reef to enhance surfing conditions | Change in number of surfers using this site compared to other sites | ● | ● | ● |

| | | | | | |
|---|---|---|---|---|---|
| **Economic** | | | | | |
| *Ensure affordability of adaptive measures* | Ensure benefits of construction and on-going maintenance outweigh costs | Change in cost/benefit ratio |  |  |  |
| *Maintain or enhance local economy associated with the coastal zone* | Incorporate landscape design principles that increase visitation through the provision of enhanced amenity. | Change in number of businesses associated with the coastal zone |  |  |  |
| **Governance** | | | | | |
| *Development and maintenance of responsive governance processes* | Adaptation strategies are widely communicated across council | Change in number of council divisions incorporating adaptation in decision-making processes |  |  |  |
| *Council staff learn from challenges and opportunities of adaptation* | Ensure all relevant staff use a systematic process for reflecting on activities. | Extent of lessons learned incorporated into future plans |  |  |  |

## Accommodate measures – Splash City Case

"Accommodate" strategies (e.g. raising houses) are implemented to accommodate for storm surge and flooding events that are episodic. While "accommodate" measures allow a degree of "business as usual" and may be the least costly strategy in the short-term, in order to persist they may need to be continually improved/re-engineered and may not be feasible over longer time periods. The "Splash City" case provides an illustrative example of key monitoring and evaluation issues associated with accommodate strategies. The example is based on some of the issues facing Rockdale, NSW.

Splash City is a predominately urban area with significant assets and infrastructure developed progressively over the last 200 years. There are a number of protection measures that have already been established including rock walls and flood protection structures. However, several independent and credible studies have concluded that these protection measures will not be satisfactory to alleviate climate change impacts over the next 100 years. To address this, various schemes were investigated using multi-criteria analysis leading to the recommendation of "accommodate" to retrofit existing residences, infrastructure and other assets at risk. Key issues for consideration included a range of social, governance, economic and environmental issues to:

- Allow for the continued use of existing housing, infrastructure and assets;
- Ensure cost efficiency;
- Ensure minimal disruption to businesses and residents; and
- Allow time to consider alternative strategies.

Specific strategies, indicators and measures were then developed to monitor and evaluate progress towards achieving positive social, economic and environmental outcomes (e.g. Cast Study 2 Template).

**Case Study 2 Template:** An example case of monitoring and evaluating the performance of an accommodate adaptation strategy (e.g. retrofitting structures)

| Adaptation objectives | Strategies | Performance criteria | Performance indicators<br>● Meeting or exceeding desired outcome/trend<br>● Moving towards a desired outcome/trend<br>● Limited to no changes towards a desired outcome<br>● Not meeting desired trend and showing signs of decline<br>● Data unavailable in reporting period | | |
|---|---|---|---|---|---|
| **Environmental** | | | **Time 1** | **Time 2** | **Time 3** |
| *Protection of biodiversity* | Update council biodiversity strategy to take into account climate change impacts (e.g. potential ecosystem fragmentation) | Change in species abundance and composition | ● | ● | ● |
| **Social** | | | | | |
| *Maintain communities* | Provide advice on retrofitting existing houses to cope with increasing exposure to climate change events | Change in number of dwellings retrofitted to cope with increasing exposure to climate change events | ● | ● | ● |
| *Reduce vulnerability of new residents* | Introduce sustainable building design requirements | Change in number of new homes complying with sustainable building design requirements | ● | ● | ● |
| *Raise awareness of climate change issues among residents* | Develop communication and education campaigns to raise awareness of climate change issues in the coastal zone | Change in number of residents who understand climate change impacts | ● | ● | ● |
| **Economic** | | | | | |
| *Maintain economic structure and activity* | Provide advice on retrofitting existing businesses to cope with increasing exposure to climate change events | Change in number of businesses retrofitted to cope with increasing exposure to climate change events | ● | ● | ● |

| | | | | | |
|---|---|---|---|---|---|
| **Governance** | | | | | |
| *Development and maintenance of responsive governance processes* | Adaptation strategies are widely communicated across council | Change in number of council divisions incorporating adaptation in decision-making processes | ● | ● | ● |
| *Council staff learn from challenges and opportunities of adaptation* | Ensure all relevant staff use a systematic process for reflecting on activities | Extent of lessons learned incorporated into future plans | ● | ● | ● |

## Retreat measures – Tide Town Case

"Retreat" strategies (e.g. re-zoning of land use) are implemented to remove communities and infrastructure from erosion, storm surge and flooding. While "retreat" measures reduce vulnerability to climatic events they can be costly and potentially have social implications due to changes in community structures and sense of place. The "Tide Town" case provides an illustrative example of key monitoring and evaluation issues associated with retreat strategies. The example is based on some of the issues facing Byron Bay, NSW.

Tide Town had implemented a number of protection measures including rock walls after erosion threatened the main area of the town. A few kilometers along the coast there is a number of residences built on the fore dune—the residential development was approved several decades ago during a period of calmer weather conditions and when a more extensive beach profile existed. However, over recent years the combined impacts of sea level rise and storm surge associated with more intense weather events has led to severe erosion that threatens the structural integrity of the homes and the safety of residents. Several independent and credible studies have concluded that the erosion of the properties will continue and worsen. To address this, Tide Town Council instigated various schemes using multi-criteria analysis leading to the recommendation of "planned retreat" to relocate the residents to a less exposed location. Key issues for consideration included a range of social, governance, economic and environmental issues to:

- Reduce exposure of properties to storm surge and sea level rise and to protect the safety of residents;
- Develop high amenity new residential areas;
- Enhance habitat restoration; and
- Ensure long-term cost efficiency through reduced onus on the broader ratepayers of the Local Government area to pay for the ongoing protection of only a few residents.

Tide Town Council then developed specific strategies, indicators and measures to monitor and evaluate progress towards achieving positive social, economic and environmental outcomes (e.g. Case Study 3 Template).

**Case Study 3 Template:** An example case of monitoring and evaluating the performance of a retreat adaptation strategy (e.g. re-zoning of land use)

| Adaptation objectives | Strategies | Performance criteria | Performance indicators<br>● Meeting or exceeding desired outcome/trend<br>● Moving towards a desired outcome/trend<br>● Limited to no changes towards a desired outcome<br>● Not meeting desired trend and showing signs of decline<br>● Data unavailable in reporting period | | |
|---|---|---|---|---|---|
| **Environmental** | | | **Time 1** | **Time 2** | **Time 3** |
| *Allow ecosystems to adapt autonomously to climate change impacts* | Re-zone highly exposed coastal residential land to conservation areas | Change in area of coastal land zoned as conservation areas | ● | ● | ● |
| **Social** | | | | | |
| *Ensure the safety of people currently residing in highly exposed coastal areas* | Condemn houses in highly exposed coastal areas | Change in number of people residing in highly exposed coastal areas | ● | ● | ● |
| *Ensure equitable long-term distribution of costs and benefits to all residents in the Local Government area* | Ceasing of Local Government expenditure on coastal residential protection measures | Change in amount of expenditure on coastal residential protection measures | ● | ● | ● |
| *Raise awareness of climate change issues among residents* | Develop communication and education campaigns to raise awareness of climate change issues in the coastal zone | Change in number of residents who understand climate change impacts | ● | ● | ● |
| **Economic** | | | | | |
| *Ensure affordability of adaptive measures* | Ensure benefits of land re-zoning outweigh costs of on-going protective measures | Change in cost/benefit ratio | ● | ● | ● |
| **Governance** | | | | | |
| *Development and maintenance of responsive governance processes* | Adaptation strategies are widely communicated across council | Change in number of council divisions incorporating adaptation in decision-making processes | ● | ● | ● |
| *Council staff learn from challenges and opportunities of adaptation* | Ensure all relevant staff use a systematic process for reflecting on activities | Extent of lessons learned incorporated into future plans | ● | ● | ● |

## Concluding remarks

The process of climate change adaptation is an ongoing iterative process that itself needs to be adaptive. Not only is the exact magnitude and extent of climate change impacts uncertain, the interactions that contribute to climate change and the way they manifest in terms of impacts are complex. Uncertainty is further compounded by dynamic socio-ecological conditions (such as changes in population size and characteristics) that influence both the sensitivity to climate change and the adaptive capacity of communities to respond. As such, adaptation is not a one-off activity. Adaptation plans and strategies need to allow for transitions to alternative adaptation pathways over time.

Transitions may be triggered when certain environmental, social or economic thresholds are exceeded. Determining such thresholds is a question for communities to debate on a case-by-case basis and will be contingent on perceptions of desirable systems states and the level of risk communities are willing to accept or have the capacity to cope with. The dialogue facilitated by working through the templates in this guide provides an opportunity to understand the on-going effects of particular strategies on future capacity and to avoid path dependencies or maladaptation. For example, extensive investment in “protect” options over the next decade may limit the ability to transition to alternative adaptation options when the “protect” pathway is deemed unsustainable. More discussion on the implications of the intent of adaptation is provided by Thomsen *et al*. (2012).

In summary, adaptation planning (and monitoring and evaluation) should account for spatial and temporal variability in social and ecological contexts. Ongoing and systematic monitoring and evaluation is crucial to understanding the efficacy, feasibility and effectiveness of adaptation plans and strategies both now and into the future.

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